Moonrise, Moonset, and Phases

Answer Key

Vocabulary: horizon, Moon phase, moonrise, moonset

Prior Knowledge Questions (Do these BEFORE using the Gizmo.)
[Note: The purpose of these questions is to activate prior knowledge and get students thinking. Students are not expected to know the answers to the Prior Knowledge Questions.]

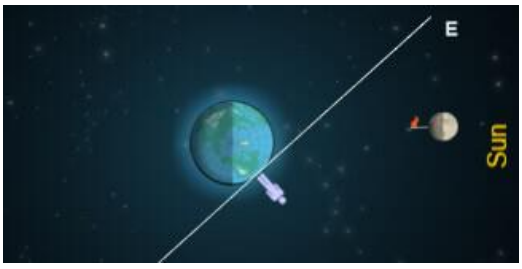
1. When is the last day and approximate time of day you recall seeing the Moon?

   Answers will vary.

   In the space at right, draw what you saw. *Drawings will vary.*

2. Does the Moon always rise and set at the same time? *Answers will vary. [No, it does not.]*

Gizmo Warm-up
The Moon is not always in the same position in the sky at a given time. Sometimes the Moon rises in the early evening, sometimes in the middle of the night, and sometimes during the day. The *Moonrise, Moonset, and Phases* Gizmo™ allows you to determine how the **Moon phases** are related to the timing of **moonrise** and **moonset**.



To begin, turn on **Show horizon**. The Gizmo shows Earth, the Moon, and an observer on Earth. The Sun is located far away to the right of Earth. The long white line is the **horizon**.

1. Click **Play** (▶). Look at the VIEW OF MOON FROM EARTH pane. What do you see?

   Sample answer: The Moon first appears as a crescent, lit up on the right side. As time goes by, the amount of the lighted part of the Moon increases until the Full Moon phase.

2. Click **Reset** (↺) and set the **Speed** to **Slow**. Click **Play**, and then click **Pause** (⏸) when the Moon is aligned with the eastern horizon (**E**).

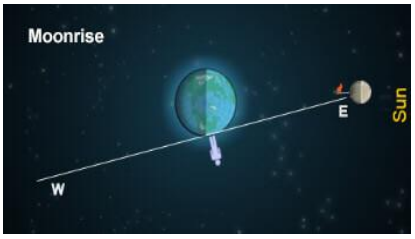
   Look to the upper left. What time is it? *About 6:00 A.M.* This is the time of moonrise.
   (The measured time in the Gizmo will be closer to 6:30 A.M.)

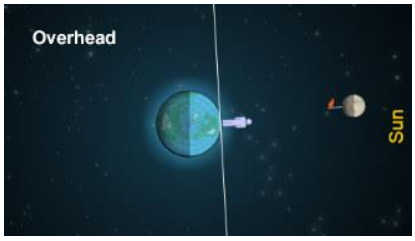
3. Click **Play** and then **Pause** when the Moon is aligned with the western (**W**) horizon.

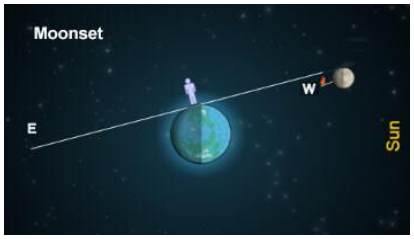
   What time is it? *About 6:00 P.M.* This is the time of moonset.

Activity: **Moonrise and moonset**	Get the Gizmo ready: • Click **Reset**. • Check that **Show horizon** is on and the **Speed** is set to **Slow**.	

Introduction: For an observer on Earth, moonrise occurs when the Moon is just over the eastern horizon. Moonset occurs when the Moon has gone below the western horizon. Between moonrise and moonset the Moon will pass overhead.







Question: How do Moon phases relate to the timing of moonrise and moonset?

1. Observe: Drag the Moon to the left side of Earth. You will see a Full Moon on the VIEW OF MOON FROM EARTH pane. Use the Gizmo to find the time of moonrise and moonset.

   A. What is the time of moonrise? *About 6:00 P.M. (May be closer to 6:30 A.M.)*

   B. At what time is the Moon directly over the observer's head? *About 12:00 midnight*

   C. What is the time of moonset? *About 6:00 A.M.*

2. Compare: In the Warm-up activity, you measured the time of moonrise and moonset during the New Moon phase. You found that the Moon rose at approximately 6:00 A.M. and set at approximately 6:00 P.M.

   How do the times of moonrise and moonset compare for the Full Moon and New Moon?

   On the Full Moon, times of moonrise and moonset are about 12 hours later than the times of moonrise and moonset for a New Moon.

3. Predict: How do you expect the times of moonrise and moonset to change as the Moon orbits Earth? *Predictions will vary.*

(Activity continued on next page)

Activity (continued from previous page)

4. Gather data: For each Moon phase listed below, use the Gizmo to find the time of moonrise, the time that the Moon is overhead, and the time of moonset. List these in the table.

   Note: The values given in the table below are theoretical. Because the image in the Gizmo is not to scale, data collected by students will vary from the values below by up to one hour. For the in-between phases (Crescent and Gibbous), there may be even more variation based on when students collect their data.

Phase	Illustration	Moonrise	Overhead	Moonset
New Moon		*6:00 A.M.*	*12:00 noon*	*6:00 P.M.*
Waxing Crescent		*9:00 A.M.*	*3:00 P.M.*	*9:00 P.M.*
First Quarter		*12:00 noon*	*6:00 P.M.*	*12:00 midnight*
Waxing Gibbous		*3:00 P.M.*	*9:00 P.M.*	*3:00 A.M.*
Full Moon		*6:00 P.M.*	*12:00 midnight*	*6:00 A.M.*
Waning Gibbous		*9:00 P.M.*	*3:00 A.M.*	*9:00 A.M.*
Third Quarter		*12:00 midnight*	*6:00 A.M.*	*12:00 noon*
Waning Crescent		*3:00 A.M.*	*9:00 A.M.*	*3:00 P.M.*

5. Analyze: What patterns do you notice in your data?

   Sample answer: Moonrise, overhead, and moonset times changed by approximately 3 hours between each phase. Overhead was always about 6 hours after moonrise, and moonset was always about 12 hours after moonrise.

6. Apply: What is the phase of the Moon if it rises at 4:00 A.M.? *Waning Crescent*

   What is the Moon phase if it reaches its highest point at 9:00 P.M.? *Waxing Gibbous*

7. Extend your thinking: In its 29.5-day cycle, the time of moonrise changes by 24 hours. How much does the time of moonrise change each day? Check your answer using the Gizmo.

   Moonrise changes by about 0.81 hours each day, or about 49 minutes. [To find the answer, divide 24 hours by 29.5 days.]